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A WINDSCREEN WIPER

BACKGROUND OF THE INVENTION

Field of the Invention

10   This invention relates to a windscreen wiper, which is also known as a windshield wiper.

Description of the Related Art

The invention relates in particular to a windscreen wiper which has a curved backbone and which may have a varying width and/or thickness. It will be appreciated

15   by those skilled in the art that the backbone may be in the form of a beam that is curved in a plane or may have compound curvature. The beam will then usually have width and thickness dimensions. The beam will also have a radius of curvature at each point along its length.

20   When such a windscreen wiper is pressed onto a surface such as the windscreen (or windshield) of a vehicle, the force intensity (the force per unit length) will vary at different positions along the length of the beam. A large number of factors affect the manner in which the force intensity distribution varies, such as:

the material from which the beam is made and the Young's modulus

25   thereof;

the length of the beam;

curvature of the beam;

curvature of the surface;

variation in any one or both of the width of the beam and the thickness

30   of the beam;

the magnitude of the force applied to the beam; and

the position, or positions, at which the force is applied.

The applicant has found that, with shorter beams, it is adequate to apply the force at a single point. However, with longer beams, ie beams that are longer than about 400mm it is preferable to apply the force to the beam at two spaced apart points. The applicant has further found that the degree of variation of force intensity resulting from changes in curvature of the surface and the magnitude of the force applied to the beam, in use, varies significantly depending on the spacing between the points of application of the force and the ratio between the spacing distance and the total length of the beam.

The applicant has further found that if the spacing between the points exceeds a certain limit, the windscreen wiper will not operate in an efficient manner. There are two main factors which should be taken into account when determining the upper bound of the spacing between the points. Firstly, the vertical clearance between the beam and a force applying member should be taken in to account when, in use, the beam changes from straight to free form and vice versa. Secondly, longitudinal movement of the beam between the force application points should also be considered, when the beam changes from straight to free form and vice versa.

Summary of the Invention and Advantages

The applicant has conducted substantial analysis in this regard and believes that he has found a relationship between the spacing distance and the total length of the beam and, consequently, between the ratio of spacing distance to total length and length, which provides a windscreen wiper that operates in an improved manner.

According to a first aspect of the invention there is provided a windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material; and

a force applying member which is connected to the backbone at two spaced apart points

with the spacing distance S (expressed in millimetres) between the points being between

$$S_1 = 0.1 * L \quad .... \quad (1)$$

and

$$S_2 = 0.35 * L \quad .... \quad (2)$$

where the length L is the total length of the backbone expressed in millimetres.

Further according to a second aspect of the invention there is provided a windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material; and

a force applying member which is connected to the backbone at two spaced apart points

with the ratio R of spacing distance S between the points and the total length L (R = S/L) being between

$$R_1 = 0.1 \quad .... \quad (3)$$

and

$$R_2 = 0.35 \quad .... \quad (4)$$

where the spacing distance S and the length L are expressed in the same units of

measure.

The preferred spacing distance S_p between the spaced apart points is about

85          $S_p = 0.363 * L - 0.000146 * L^2$ .... (5)

and the preferred ratio R_p is about

$R_p = 0.363 - 0.000146 * L$ .... (6)

90   The force applying member may be connected to the backbone in such a manner as to permit relative longitudinal displacement between the force applying member and the backbone.

The curved backbone may have a varying width and or thickness, along its 95 length. The backbone may further have a free form curvature in a plane or may have a compound curvature (that is curved in two planes).

It will be appreciated that the force applying member normally straddles the geometric centre of the backbone. This is particularly so for a windscreen wiper that 100 is intended for use on a driver's side. However, the force applying member may be positioned off-centre for certain cases, such as on passenger side windscreens. In that way the overall performance of the wiper may be optimised.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is now described, by way of example with reference to the 105 accompanying drawings. In the drawings,

Figure 1 shows schematically a windscreen wiper in accordance with the invention;

Figure 2 or Graph A illustrates the beam width at various positions along the length

of the beam;

Figure 3 or Graph B illustrates the thickness of the beam at various positions along the

110   length of the beam;

Figure 4 or Graph C shows the beam centre-line coordinate relative to the position

along the length of the beam;

Figure 5 or Graph D illustrates the typical clearance required for the beam as a

function of spacing distance S; and

115   Figure 6 or Graph E illustrates the typical amount of longitudinal movement between

the beam and the pin when the beam changes shape from curved to straight and vice-

versa.

The windscreen wiper 10 includes a backbone 12 which is in the form of a

120   beam. The beam is made from spring steel having a Young's modulus of 205GPa.

The length of the beam is 700mm. The beam tapers both in width and thickness from

its centre toward its free ends or tips as shown in Graph A and Graph B respectively.

Graph A illustrates the beam width (in millimetres) at various positions along the

length of the beam, which is also measured in millimetres. Graph B illustrates the

125   thickness of the beam (in millimetres) at various positions along the length of the

beam which is also measured in millimetres.

Detailed Description of Preferred Embodiments

The beam is curved longitudinally, in a plane, with a predetermined radius of

curvature at every point along its length. Graph C shows the beam centre-line

130   coordinate relative to the position along the length of the beam (in millimetres).

A force applying member 14 is connected to the beam 12 at two spaced apart points 16 and 18, with a spacing distance S between the points. At the point 16, the force applying member 14 is connected to the beam 12 by means of a pin 20 which is pivotally located in a complementary hole in the beam 12 which does not permit relative longitudinal movement between the beam 12 and the force applying member 14. At the other point 18, the force applying member 14 is connected to the beam 12 by means of a pin 22 which is received in a longitudinal slot 24 in the beam 12 so that relative longitudinal and pivotal movement between the pin 22 and beam 12 is permitted.

It will be appreciated that there needs to be clearance between the force applying member 14 and a line between the points 16 and 18, indicated at 26, in which the section of the beam 12 between the points 16 and 18 can move when the beam changes shape from curved to straight and vice-versa.

Graph D illustrates the typical clearance 26 required for the beam 12 described above as a function of spacing distance S and Graph E illustrates the typical amount of longitudinal movement between the beam 12 and the pin 22 when the beam 12 changes shape from curved to straight and vice-versa.

The spacing S is 150mm. In this case, the ratio R of spacing distance S between the points 16 and 18 and the total length L (R = S/L) is therefore 0,214.